PATENT SPECIFICATION 1,075,254

NO DRAWINGS.

The inventor of this invention in the sense of being the deviser thereof within the meaning of Section 16 of the Patents Act, 1949 is:— SIEGFRIED WILHELM HERMANN BELLINGEN, of Immenschuur 27, Hamburg-Volksdorf, Germany, of German nationality.

1,075,254

Date of Application and filing Complete Specification: July 13, 1965. No. 29635/65.

Application made in Germany (No. B78409 IVa/46c[4]) on Sept. 4, 1964.

Complete Specification Published: July 12, 1967.

Index at Acceptance:—C5 F(401, 531, 535, 537, 552, 795, 796).

Int. Cl.:—C 10 m 1/26, C 10 m 3/20.

COMPLETE SPECIFICATION.

Anti-Corrosion Additive for the Cooling Liquid in Internal Combustion Engines.

We, THE BRITISH PETROLEUM COMPANY LIMITED, of Britannic House, Finsbury Circus, London, E.C.2, England, a company incorporated in accordance with the Laws of England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an anti-corrosion additive for the liquid which is used as the cooling medium in internal combustion engines and in particular to an additive which reduces the cavitation erosion which is particularly liable to occur in the cooling systems of high-performance diesel engines for locomotive and marine purposes.

Cavitation erosion is the result of a combination of mechanical and chemical stress acting alternately on a material surface. In the cooling systems of internal combustion engines it is caused by the transmission of vibration from the engine to the cooling fluid and in particular the high frequency cylinder liner vibration which occurs when the piston hits the liner wall when it changes its slide path at top and bottom dead centre. The vibration transmitted to the cooling liquid may cause local low pressure zones in which the liquid may turn into vapour. In other words the vibration may cause vapour cavities to form and break down in rapid succession.

[*Price* 4*s.* 6*d.*]

At the point where the vapour cavities collapse damage is likely to occur to the metal surface and this may result in the destruction of surface layers which help to resist corrosive reactions. If this destruction occurs apparently minor cavitation erosion can provide a starting point for a more serious attack by conventional chemical corrosive reactions.

Both in practice and in magnetostriction vibration tests corrosion inhibitors have been found to retard the rate of damage in systems exposed to severe conditions of chemical corrosion and mild conditions of cavitation erosion. Under severe conditions of cavitation errosion corrosion inhibitors may reduce the chemical attack which follows damage to surface layers as described above but they do not give sufficient protection to the cooling system.

It is possible to tackle the problem of cavitation erosion by reducing the vibration caused by the engine and/or devising new alloys which are less susceptible to this form of attack. However both of these are particularly difficult and it is therefore desirable to devise cooling liquids which have a reduced tendency to cause this damage.

According to the invention an aqueous coolant, suitable for use in the cooling system of an internal combustion engine to reduce cavitation erosion, consists of a water based cooling fluid containing emulsified therein 0.1—10%, preferably 0.5—

2.0%, by weight of a disperse phase which consists of:—

(a) 1—99% by weight of
an animal oil or a vegetable oil, or
a synthetic equivalent thereof, or
such an oil which has been air blown,
e.g. glycerol and ethylene glycol esters preferably of fatty acids having 15—25 carbon atoms per molecule, and

(b) 99—1% by weight of an ester which contains at least 10 carbon atoms per molecule and is an ester of a polycarboxylic acid having at least one carbon atom between any pair of carboxylic groups and a monohydric alcohol.

Esters of stearic and oleic acid are particularly suitable for use as component (a), e.g. glycerol tristearate, glycerol trioleate, ethylene glycol distearate and ethylene glycol dioleate are particularly suitable synthetic materials. Naturally occuring materials which are suitable for use as component (a) include sperm oil, olive oil, ground nut oil, blown or unblown castor oil.

Esters which are particularly suitable for use as component (b) include:—

Phthalic acid amyl hexyl ester,
Benzyl nonyl sebacate,
Suberic acid diamyl ester,
Monocetyl fumaric acid ester,
Hexahydro phthalic acid di-butyl ester and
Octyl-nonyl sebacate

Of these octyl-nonyl sebacate is considered to be particularly suitable.

It is considered desirable that the two components of the composition should have different chain lengths.

To avoid an undesirably high volatility in the disperse phase it is desirable to avoid using a component which is prepared by the esterification of low molecular weight acids and alcohols.

Preferably the disperse phase contains 70—90% by weight of component (a) and 30—10% by weight of component (b).

The coolant may also contain an emulsifying agent, e.g. an aliphatic polyglycol ester, which assists in maintaining the stability of the emulsion. Anti-foaming agents may also be included if desired.

The invention also includes a method of reducing cavitation errosion in the cooling system of a diesel engine in which heat is removed by the circulation of an aqueous coolant as hereinbefore defined.

Four compositions according to the invention will now be described, by way of example. These compositions were bench tested using coupled vibrators which were excited magnetostrictively to give longitudinal vibration; the test conditions were:—

Amplitude	25μ
Frequency	19 kc/s
Pressure	1 atmosphere
Temperature	55°C
Test Piece	Cast Iron

(A high water temperature would reduce the solubility of gas in the water thereby reducing its tendency to form cavities and hence the intensity of the liquid cavitation). Comparative tests have shown that these coupled vibrators are well suited to reproduce conditions prevailing in an engine.

The disperse phases of the four aqueous coolants according to the invention tested had the following compositions:—

(i) 70% weight castor oil + 30% weight octyl nonyl sebacate
(ii) 70% weight sperm oil + 30% weight octyl nonyl sebacate
(iii) 70% weight olive oil + 30% weight octyl nonyl sebacate
(iv) 70% weight groundnut oil + 30% weight octyl nonyl sebacate.

Each of these four compositions was emulsified to give a 1% by weight oil-in-water emulsion. In one hour's testing as described above the emulsion prepared from composition (i) caused the test piece to lose 2.5 mg. The other emulsions gave weight losses ranging from 2.6—3.4 mg.

A commercial anti-corrosive oil, when tested as described, gave a weight loss of 22 mg after one hour. (The oil used was an emulsifiable mineral oil which contained conventional additives).

WHAT WE CLAIM IS:—

1. An aqueous coolant, suitable for use in the cooling system of an internal combustion engine to reduce cavitation erosion of the cooling system, which consists of a water based cooling fluid containing emulsified therein 0.1—10% by weight of a disperse phase which consists of:—

(a) 1—99% by weight of
an animal or vegetable oil, or
a synthetic equivalent thereof, or
such an oil which has been air blown,

(b) 99%—1% by weight of an ester which contains at least 10 carbon atoms per molecule and is an ester of a polycarboxylic acid having at least 1 carbon atom between any pair of carboxylic groups and a mono-hydric alcohol.

2. An aqueous coolant according to claim 1, in which component (a) is a synthetic ester of glycerol.

3. An aqueous coolant according to claim 1, in which component (a) is a synthetic ester of ethylene glycol.

4. An aqueous coolant according to either claim 2 or claim 3, in which com-

ponent (a) is an ester of a fatty acid having 15—25 carbon atoms per molecule.

5. An aqueous coolant according to claim 4, in which component (a) is a stearate or an oleate.

6. An aqueous coolant according to claim 1, in which component (a) is glycerol tristearate, glycerol trioleate, ethylene glycol distearate or ethylene glycol dioleate.

7. An aqueous coolant according to claim 1 in which component (a) is sperm oil, olive oil, ground nut oil or castor oil.

8. An aqueous coolant according to any one of the preceding claims, in which component (b) is an ester of a dicarboxylic acid.

9. An aqueous coolant according to claim 8, in which component (b) is octyl nonyl sebacate.

10. An aqueous coolant according to any one of the preceding claims in which the chain length of component (a) differs from the chain length of component (b).

11. An aqueous coolant according to any one of the preceding claims, which contains 70—90% by weight of component (a) and 30—10% by weight of component (b).

12. An aqueous coolant according to claim 1, in which the disperse phase is composition (i) as hereinbefore defined.

13. An aqueous coolant according to claim 1, in which the disperse phase is composition (ii) as hereinbefore defined.

14. An aqueous coolant according to claim 1, in which the disperse phase is composition (iii) as hereinbefore defined.

15. An aqueous coolant according to claim 1 in which the disperse phase is composition (iv) as hereinbefore defined.

16. An aqueous coolant according to any one of the preceding claims, which contains 0.5—2% by weight of the disperse phase.

17. An aqueous coolant according to any one of the preceding claims, which contains an aliphatic poly-glycol ester as an emulsifying agent to stabilise the emulsion.

18. A method of reducing cavitation erosion in the cooling system of a diesel engine, in which heat is removed by means of an aqueous coolant as defined in any one of claims 1—17.

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Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1967.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.